



Product Specification

XBL1509B Series

150KHz 2A PWM Buck DC/DC Converter

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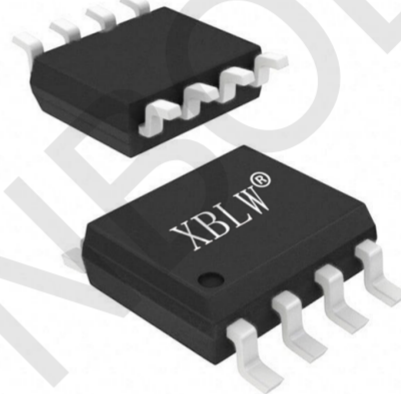
Descriptions

The XBL1509B is a 150 KHz fixed frequency PWM buck (step-down) DC/DC converter, capable of driving a 2A load with high efficiency, low ripple and excellent line and load regulation. Requiring a minimum number of external components, the regulator is simple to use and include internal frequency compensation and a fixed-frequency oscillator.

The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%. An enable function, an over current protection function is built inside. When second current limit function happens, the operation frequency will be reduced from 150KHz to 50KHz. An internal compensation block is built in to minimize external component count.

Features

- Wide 4.5V to 40V Input Voltage Range
- 3.3V, 5V, 12V, and adjustable versions
- Output Adjustable from 1.23V to 37V
- Maximum Duty Cycle 100%
- Minimum Drop Out 1.0V
- Fixed 150KHz Switching Frequency
- 2A Constant Output Current Capability
- Internal Optimize Power Transistor
- High efficiency
- TTL shutdown capability
- Excellent line and load regulation
- Built in thermal shutdown function
- Built in current limit function
- Built in output short protection function
- Available in SOP-8 packages



SOP-8

Applications

- Portable DVD
- LCD Monitor / TV
- Battery Charger
- ADSL Modem
- Telecom / Networking Equipment

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBL1509B-3.3	SOP-8	XBL1509B-3.3	Tape	4000Pcs/Reel
XBL1509B-5.0	SOP-8	XBL1509B-5.0	Tape	4000Pcs/Reel
XBL1509B-12	SOP-8	XBL1509B-12	Tape	4000Pcs/Reel
XBL1509B-ADJ	SOP-8	XBL1509B-ADJ	Tape	4000Pcs/Reel

Pin Configurations

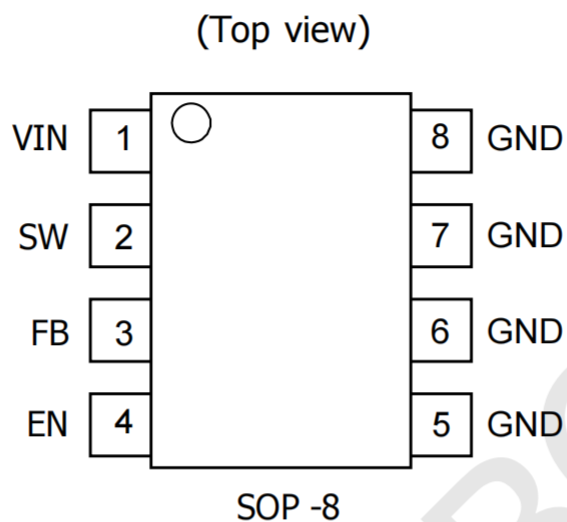


Figure 1.Pin Configuration of XBL1509B (Top View)

Pin Description

Pin Number	Pin Name	Description
1	VIN	Supply Voltage Input Pin. XBL1509B operates from a 4.5V to 40V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
2	SW	Power Switch Output Pin (SW). Output is the switch node that supplies power to the output.
3	FB	Feedback Pin (FB). Through an external resistor divider network, Feedback senses the output voltage and regulates it. The feedback threshold voltage is 1.23V.
4	EN	Enable Pin. Drive EN pin low to turn on the device, drive it high to turn it off. Floating is default low.
5/6/7/8	GND	Ground Pin.

Function Block

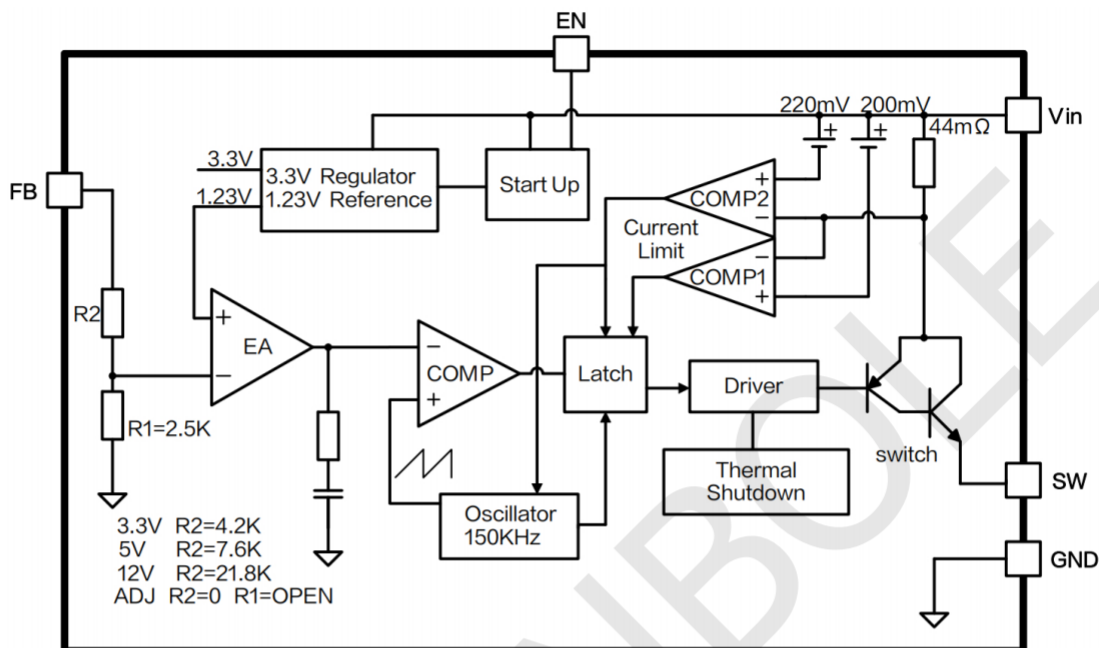


Figure 2. Function Block Diagram of XBL1509B

Typical Application Circuit

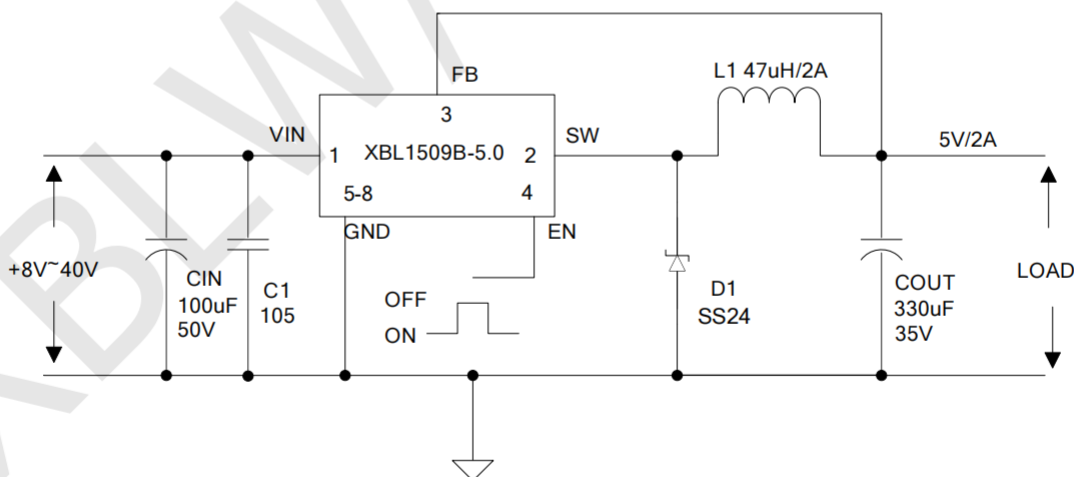


Figure 3. XBL1509B-5.0 Typical Application Circuit (VIN=8V~40V, VOUT=5V/2A)

Absolute Maximum Ratings

Note1: Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	-0.3 to 45	V
Feedback Pin Voltage	V_{FB}	-0.3 to V_{IN}	V
Enable Pin Voltage	V_{EN}	-0.3 to V_{IN}	V
Switch Pin Voltage	V_{SW}	-0.3 to V_{IN}	V
Power Dissipation	P_D	Internally limited	mW
Operating Junction Temperature	T_J	-40~125	°C
Storage Temperature	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	°C
ESD (HBM)		2000	V
MSL		Level3	
Thermal Resistance-Junction to Ambient	$R_{\theta JA}$	85	°C / W
Thermal Resistance-Junction to Case	$R_{\theta JC}$	45	°C / W

Recommended Operation Conditions

Symbol	Parameter	Range	Unit
V_{IN}	V_{IN} Supply Voltage	4.5 ~ 40	V
T_{OPR}	Operating Junction Temperature	-40~125	°C

XBL1509B-3.3 Electrical Characteristics

$T_A = 25^{\circ}\text{C}$; unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure 5						
V_{OUT}	Output Voltage	$V_{in} = 4.75\text{V to } 40\text{V}$ $I_{load}=0.2\text{A to } 2\text{A}$	3.168	3.3	3.432	V
η	Efficiency	$V_{in}=12\text{V}$, $V_{out}=3.3\text{V}$ $I_{out}=2\text{A}$	-	75	-	%

XBL1509B-5.0 Electrical Characteristics

$T_A = 25^{\circ}\text{C}$; unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure 6						
V_{OUT}	Output Voltage	$V_{in} = 7\text{V to } 40\text{V}$, $I_{load}=0.2\text{A to } 2\text{A}$	4.8	5	5.2	V
η	Efficiency	$V_{in}=12\text{V}$, $V_{out}=5\text{V}$, $I_{out}=2\text{A}$	-	82	-	%

XBL1509B-12 Electrical Characteristics

T_A = 25°C; unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure 7						
V _{OUT}	Output Voltage	V _{in} = 15V to 40V, I _{load} =0.2A to 2A	11.52	12	12.48	V
η	Efficiency	V _{in} =25V, V _{out} =12V, I _{out} =2A	-	90	-	%

XBL1509B-ADJ Electrical Characteristics

T_A = 25°C; unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure 8						
V _{OUT}	Output Voltage	V _{in} = 4.5V to 40V, I _{load} =0.2A to 2A	1.193	1.23	1.267	V
η	Efficiency	V _{in} =12V, V _{out} =3V, I _{out} =2A	-	74	-	%

Electrical Characteristics (DC Parameters)

V_{in} = 12V for the 3.3V, 5V, and Adjustable versions and V_{in}=24V for the 12V version, GND=0V, V_{in} & GND parallel connect a 220uF/50V capacitor; I_{out}=500mA, T_A = 25°C; the others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V _{in}		4.5		40	V
Shutdown Supply Current	I _S	V _{EN} = 5V		50	200	uA
Quiescent Supply Current	I _q	V _{EN} =0V, V _{FB} =V _{in}		4.5	10	mA
Oscillator Frequency	F _{osc}		127	150	173	Khz
Switch Current Limit	I _L	V _{FB} =0V		4.0		A
EN Pin Threshold	V _{EN}	High (Regulator OFF) Low (Regulator ON)		1.4 0.8		V
EN Pin Input Leakage Current	I _H	V _{EN} =2.5V (OFF)		8	15	uA
	I _L	V _{EN} =0.5V (ON)		0.5	5	uA
Output Saturation Voltage	V _{CE}	V _{FB} =0V I _{out} =2A		1.2	1.5	V
Max. Duty Cycle	D _{MAX}	V _{FB} =0V		100		%

Test Circuit and Layout guidelines

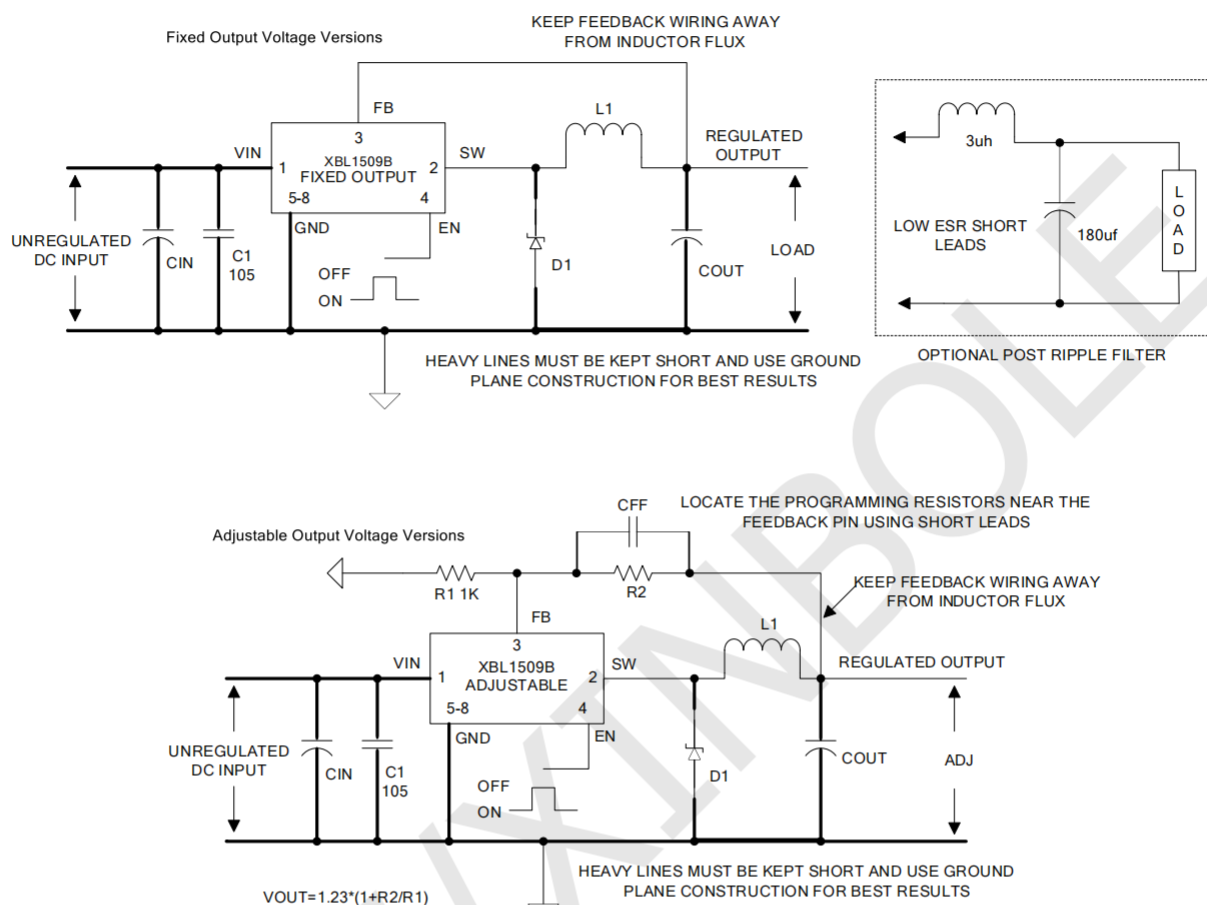


Figure 4. Standard Test Circuits and Layout Guides

Select R1 to be approximately 1K, use a 1% resistor for best stability.

C1 and CFF are optional; in order to increase stability and reduce the input power line noise, C1 must be placed near to PIN1 and PIN3;

For output voltages greater than approximately 10V, an additional capacitor CFF is required. The compensation capacitor is typically between 100 pf and 33 nf, and is wired in parallel with the output voltage setting resistor, R2. It provides additional stability for high output voltage, low input-output voltages, and/or very low ESR output capacitors, such as solid tantalum capacitors.

$CFF = 1 / (31 \cdot 1000 \cdot R_2)$; This capacitor type can be ceramic, plastic, silver mica, etc. (Because of the unstable characteristics of ceramic capacitors made with Z5U material, they are not recommended.)

XBL1509B Series Buck Regulator Design Procedure (Fixed Output)

Conditions			Inductor (L1) Inductance (uH)	Output Capacitor (COUT)			
Output Voltage (V)	Load Current (A)	Max Input Voltage (V)		Through Hole Electrolytic	Surface Mount Tantalum		
3.3	2	6	22	Panasonic HFQ Series (uF/V) 470/25	Nichicon PL Series (uF/V) 470/35	AVX TPS Series (uF/V) 330/6.3	Sprague 595D Series (uF/V) 390/6.3
		10	33	330/35	330/35	330/6.3	390/6.3
		40	47	330/35	270/50	220/10	330/10
5	2	9	22	470/25	560/16	220/10	330/10
		20	68	180/35	180/35	100/10	270/10
		40	68	180/35	180/35	100/10	270/10
12	2	15	33	330/25	330/25	100/16	180/16
		20	68	180/25	180/25	100/16	120/20
		40	150	82/25	82/25	68/20	68/25

XBL1509B Series Buck Regulator Design Procedure (Adjustable Output)

Output Voltage (V)	Through Hole Output Electrolytic			Surface Mount Output Capacitor		
	Panasonic HFQ Series (uF/V)	Nichicon PL Series (uF/V)	Feedforward Capacitor	AVX TPS Series (uF/V)	Sprague 595D Series (uF/V)	Feedforward Capacitor
2	820/35	820/35	33nF	330/6.3	470/4	33nF
4	560/35	470/35	10nF	330/6.3	390/6.3	10nF
6	470/25	470/35	3.3nF	220/10	330/10	3.3nF
9	330/25	330/25	1.5nF	100/16	180/16	1.5nF
12	330/25	330/25	1nF	100/16	180/16	1nF
15	220/25	220/35	680pF	68/20	120/20	680pF
24	220/35	150/35	560pF	33/25	33/25	220pF
28	100/50	100/50	390pF	10/35	15/50	220pF

Schottky Diode Selection Table

Current	Surface Mount	Through Hole	VR (The same as system maximum input voltage)				
			20V	30V	40V	50V	60V
1A		√	1N5817	1N5818	1N5819		
2A		√	1N5820	1N5821	1N5822		
		√	MBR320	MBR330	MBR340	MBR350	MBR360
	√		SS32	SS33	SS34	SS35	SS36
	√			30WQ03	30WQ04	30WQ05	
		√		31DQ03	31DQ04	31DQ05	
		√	SR302	SR303	SR304	SR305	SR306

Typical System Application for 3.3V Version

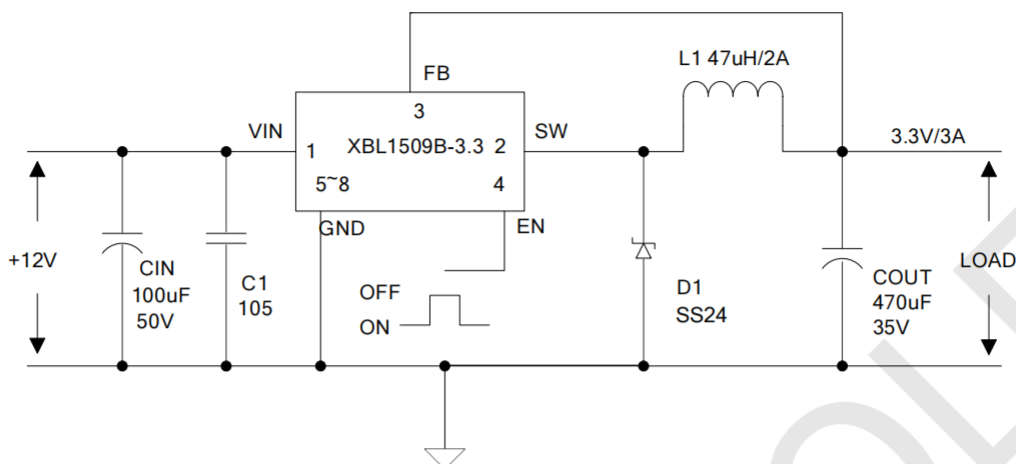


Figure 5. XBL1509B-3.3 System Parameters Test Circuit

Typical System Application for 5V Version

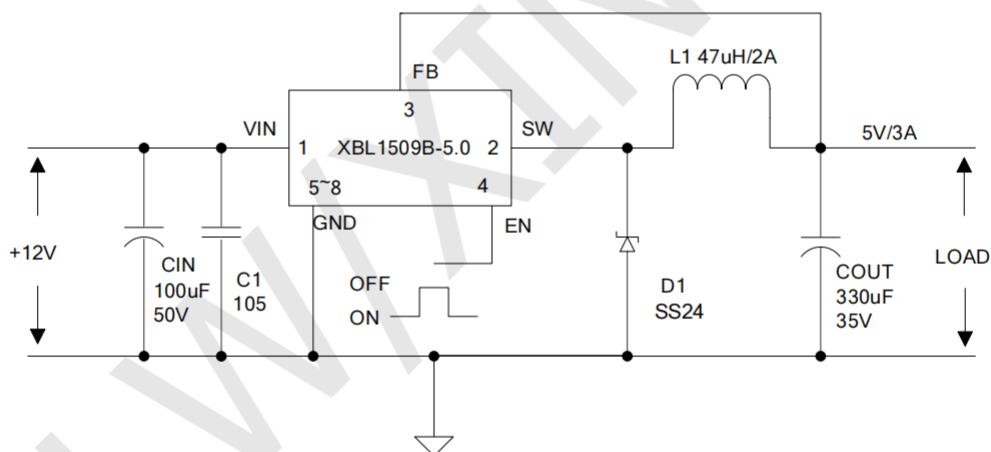


Figure 6. XBL1509B-5.0 System Parameters Test Circuit

Typical System Application for 12V Version

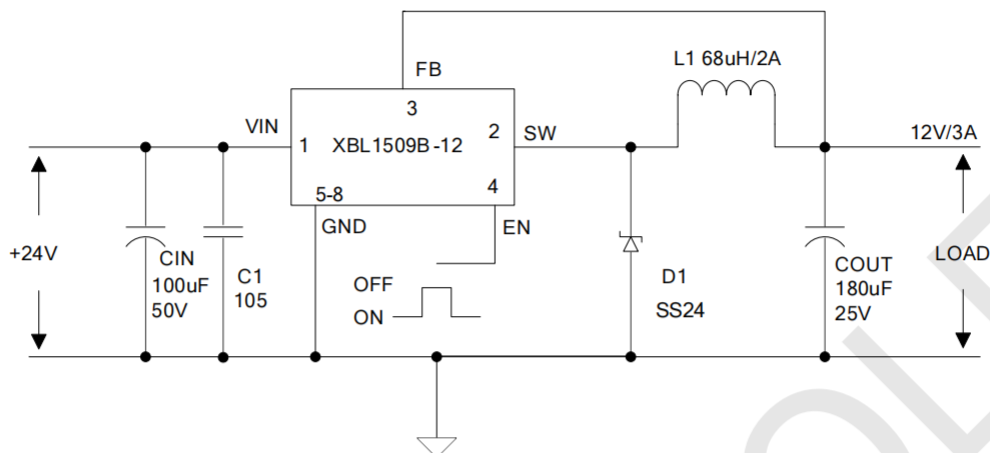


Figure 7. XBL1509B--12 System Parameters Test Circuit

Typical System Application for ADJ Version

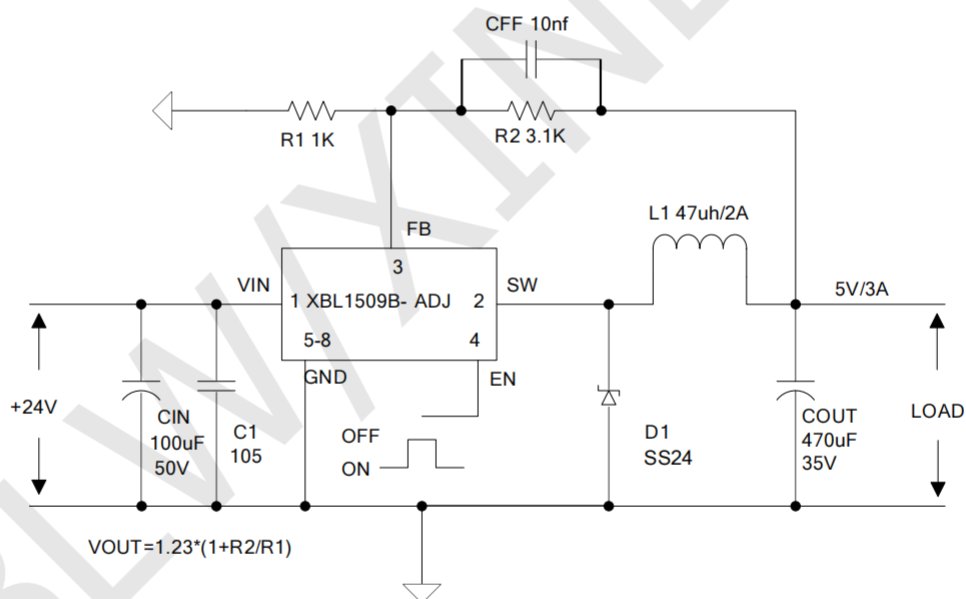
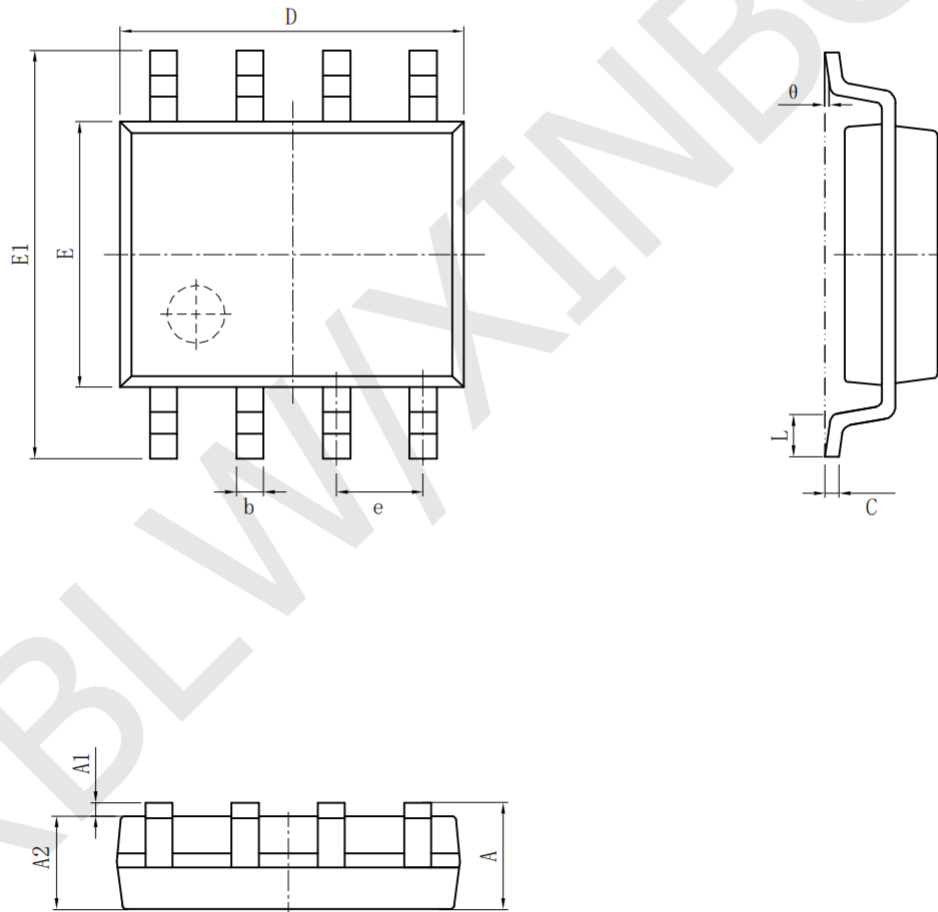


Figure 8. XBL1509B-ADJ System Parameters Test Circuit

Package Information

• SOP-8

Size Symbol	Dimensions In Millimeters		Size Symbol	Dimensions In Inches	
	Min (mm)	Max (mm)		Min (in)	Max (in)
A	1.350	1.750	A	0.053	0.069
A1	0.100	0.250	A1	0.004	0.010
A2	1.350	1.550	A2	0.053	0.061
b	0.330	0.510	b	0.013	0.020
c	0.170	0.250	c	0.006	0.010
D	4.700	5.100	D	0.185	0.200
E	3.800	4.000	E	0.150	0.157
E1	5.800	6.200	E1	0.228	0.224
e	1.270 (BSC)		e	0.050 (BSC)	
L	0.400	1.270	L	0.016	0.050
θ	0°	8°	θ	0°	8°



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